passing rate for target volumes was found to be above 96% for a 3%/3mm criteria. Differences in tumor control probability were within 2.5% for liver and breast, however, for head-and-neck and prostate patients the differences were up to 6.5% and up to 11% for lung patients.
We conclude that approximations introduced in analytical dose calculation methods can result in significant range uncertainties for heterogeneous patient geometries or introduce a systematically reduced dose in target volumes. Routine MC simulations for treatment planning or verification may be necessary to ensure full target coverage to the prescribed dose levels. In particular for clinical trials comparing photon vs. proton treatments, MC simulations may be required to avoid bias due to differences in dose calculations.

SP-0112
Proton beam monitor chamber calibration in clinical practice
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This talk describes the reference dosimetry of clinical proton beams. The main goal is to clarify the application of the IAEA TRS-398 dosimetry Code of Practice to modern proton beam delivery systems. A clear distinction is made between (i) those proton beam delivery systems that should be calibrated with an SOBP field, and (ii) those delivery systems that should be calibrated with a mono-energetic field. For these second type of delivery systems, a word of caution is issued on the use of cylindrical ionisation chambers. Contrary to the IAEA TRS-398 recommendations, this talk presents different arguments in favour of taking the effective point of measurement of cylindrical chambers into account when positioning the reference point of the chamber at the measurement depth. Finally, this talk also discusses the comparison between reference dosimetry and other independent dosimetry techniques, such as Faraday cup dosimetry and water calorimetry.

SP-0113
Myth and reality of image guidance and adaptive treatments in proton therapy
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The finite range of protons makes the delivered dose distribution, particularly in case of IMPT, very sensitive to any uncertainty and change in patient anatomy. In the best case, the patient anatomy and the treatment plans are robust over the entire treatment course such that treatment adaptation is not necessary. Adaptive therapy is, however, not simply a buzz-word, especially not for the relatively new indications for proton therapy in the thoracic and pelvic region. Existing and new proton therapy centers are working towards a framework that allows them to
1) determine which patients will benefit from a treatment adaptation.
2) efficiently adapt and validate the treatment plan.
The tools for such a framework are; volumetric image-guidance, dose-recalculation and accumulation, and plan-reoptimization. This presentation will discuss the needs for these tools, their availability and integration, and the current reality in plan adaptation in proton therapy.

Symposium with Proffered Papers: Advanced treatment planning techniques

SP-0114
Adaptive dose painting in head and neck
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The benefit of intensity-modulated radiation therapy (IMRT) in the treatment of head-and-neck cancer (HNC) has been demonstrated in numerous studies. Highly conformal radiation allows for a high dose to high-risk areas, whilst sparing adjacent organs at risk (OAR) such as the parotid glands. Clinical studies have shown that IMRT reduces grade-3 xerostomia in comparison to three-dimensional conformal radiotherapy. The next step is to develop dose-escalation studies, that so called “Dose painting”. Dose-painting IMRT is aimed at exploiting inhomogeneous dose distributions adapted to tumor heterogeneity. Tumor regions of increased radiation resistance receive escalated dose levels, whereas radiation-sensitive regions receive conventional or even de-escalated dose levels. Dose painting relies on biologic imaging. On the other hand, the changes to the dose distribution during treatment based on specific patients variations due to weight loss and tumor shrink must be corrected. For that purpose Adaptative Radiotherapy is developed. This is done by means of:
a) Image guided RT: Repositioning of the patient at the time of treatment
b) Dose tracking: Computiong fraction dose based on daily cone-beam CT, accumulating dose by deformable registration and evaluating the accumulated dose at different organs
c) Replanning: Adapt the dose to a systematic volumentric changes and compensate for undesired dose accumulation.
We will review the whole process and we will discuss the clinical data published and some of the new trials that are under evaluation.

SP-0115
Adaptive treatment planning in soft tissue sarcoma: Why and when is it necessary?
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Radiotherapy is an integral part of soft tissue sarcoma (STS) multidisciplinary management, with local control in excess of 90 % for disease arising in the extremities.
From our recently published *Phase 2 study of preoperative image-guided intensity modulated radiation therapy (IG-IMRT) to reduce wound and combined modality morbidities in lower extremity soft tissue sarcoma (LE-STS)*, approximately 20 % of the patient population required replanning during their course of radiation therapy (RT) due to soft tissue/tumour volume changes exceeding 1 cm as measured on daily cone beam CT localization used for RT guidance.
Previous work evaluated the dosimetric effect of tumour volume changes (TVC) for preoperative IMRT of LE-STS to determine critical indicators, as measured on daily CBCT localization, to motivate plan adaptation. We found that a 1 cm TVC deviation on CBCT imaging was a reliable threshold